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RESEARCH ARTICLE

Herpes Zoster Vaccine Coverage in Older Adults in the U.S., 2007–2013

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Introduction: This study aimed to assess the coverage of herpes zoster (HZ) vaccine among a large cohort of insured individuals aged ≥50 years from 2007 to 2013, and to determine the factors associated with being vaccinated for adults aged ≥60 years.

Methods: This was a retrospective, observational study using the MarketScan® database conducted in 2015. The study population was U.S. adults aged ≥60 years during 2007−2013 and 50–59 years during 2011–2013. The claims of each eligible subject were evaluated post–index date to assess HZ vaccine uptake. Multivariate analyses were performed to understand factors associated with receiving HZ vaccine.

Results: A total of 6,746,476 adults aged ≥60 years and 6,770,294 adults aged 50–59 years were identified. By 2013, 1.7% of adults aged 50–59 years, 23.9% of adults aged 60–64 years, and 14.5% of adults aged ≥65 years received HZ vaccine. Adults aged ≥65 years were less likely to receive HZ vaccine than those aged 60–64 years (hazard ratio [HR]=0.543; 95% CI=0.539, 0.547). Adults who were female, immunocompetent, and had more outpatient hospital, doctor office, and pharmacy visits were more likely to receive HZ vaccine. Adults who received influenza vaccine were more likely to receive HZ vaccine (HR=1.841; 95% CI=1.830, 1.853).

Conclusions: Estimated HZ vaccine coverage is 19.5% in adults aged ≥60 years, which is lower than the Healthy People 2020 target of 30%. Providers should identify every opportunity for HZ vaccination to assure that older adults are protected from HZ, a vaccine-preventable disease.

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INTRODUCTION

Herpes zoster (HZ), or shingles, is a cutaneous disease caused by the reactivation of latent varicella zoster virus from dorsal root or cranial nerve ganglia, present because of primary infection with varicella, or chicken pox.[1] Almost one in three individuals will develop HZ in their lifetime, amounting to 1 million cases each year in the U.S.[2,3] The risk of HZ increases sharply with age, affecting up to half of all people who live to age 85 years and causing long-term morbidity.[1]

Postherpetic neuralgia is a commonly reported complication,[4–6] which is a chronic neuropathic pain syndrome caused by peripheral sensory nerve damage and altered central nervous system signal processing. Postherpetic neuralgia can be severe and debilitating, and can persist 90 or more days after rash onset caused by HZ. Other severe complications of HZ include encephalitis, myelitis, cranial- and peripheral-nerve palsies, and a syndrome of delayed contralateral hemiparesis.[6] HZ has a significant negative effect on the quality of life and productive work life of individuals, resulting in a significant economic and resource burden on the U.S. healthcare system.[2,7–14]

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As the mean age of the U.S. population increases, the incidence of HZ is predicted to rise.[15] Vaccination of older adults may prevent or attenuate HZ.[1] An HZ vaccine was licensed in 2006 for prevention of HZ among adults aged ≥60 years. In March 2011, the U.S. Food and Drug Administration approved the use of HZ vaccine in adults aged 50–59 years. Since 2006, the Advisory Committee on Immunization Practices (ACIP) has recommended HZ vaccine for adults aged ≥60 years. In 2011, ACIP considered including adults aged 50–59 years in the recommendation, but declined to do so.

According to National Health Interview Survey data, the estimated HZ vaccination coverage among adults aged ≥60 years (15.8% in 2011, 20.1% in 2012, and 24.2% in 2013) was well below the Healthy People 2020 target coverage level of 30%.[16] Only one claims database study has examined HZ vaccination coverage. Hechter et al.[17] assessed HZ vaccination coverage during 2007–2011 in a privately insured population using Kaiser Permanente Southern California electronic medical record data. They estimated that HZ vaccination coverage reached 21.7% in 2011. They also found that the coverage was higher among people aged 65–74 years, women, and non-Hispanic whites.

An advantage to using claims data is that it is an abundant and standardized source of patient information that provides a holistic view of the patient's interactions with the healthcare system. The objectives of this study were to assess the coverage of HZ vaccine among a large cohort of insured individuals aged ≥50 years from 2007 to 2013, and to determine the factors associated with being vaccinated for adults aged ≥60 years. This study provides coverage rates among a privately insured population, while also providing a supplement to the vaccination rate assessed by the National Health Interview Survey in 2013.[16]

METHODS

Study Design and Data Source

This was a retrospective observational study conducted in 2015. Two Truven Health MarketScan® databases were used: the Commercial Claims and Encounters database and the Medicare Supplemental and Coordination of Benefits database. Truven Health provides healthcare data, analytics, and consulting services for improving business and clinical outcomes. The commercial database represents approximately 100 employer-sponsored private health plans with coverage of approximately 45 million members. The Medicare Supplemental is a database of approximately 3.7 million retirees covered by their previous employers. Both databases record patient demographic data, health plan information, medical diagnosis/procedure codes, prescriptions, and cost data. Each member in the databases has a unique identifier that can be used to track patient across the sites of service, providers, and over time. Although there is no visibility to what parts of Medicare a person is enrolled in the Medicare Supplemental database, the database contains the full healthcare information (inpatient, outpatient, and pharmacy) of a retiree from both Medicare and the employer-sponsored supplemental plans. IRB approval was not obtained because this study was an analysis of deidentified secondary data.

Subjects were included in this study if they: were aged ≥60 years during 2007–2013 or 50–59 years during 2011–2013; and were continuously enrolled in a health plan for at least 1 year before the index date, which was defined as January 1, 2007 or January 1 of the calendar year when the subject turned 60 years during 2007–2013 (or January 1, 2011 or January 1 of the calendar year when the subject turned 50 years during 2011–2013), whichever was latest.

Measures

HZ vaccine was identified by Current Procedural Terminology, 4th edition, code 90736 from medical claims and National Drug Codes 00006–4963-00, 00006–4963-41, 54868–5703-00 from pharmacy claims. The claims of each eligible subject were evaluated post−index date to assess HZ vaccine uptake. HZ vaccine coverage was measured as the proportion of eligible subjects who received HZ vaccine. Both yearly HZ vaccine coverage and cumulative HZ vaccine coverage were assessed. HZ vaccine coverage was stratified by calendar year (2007–2013), age group (50–59, 60–64, and ≥65 years), and sex (female, male).

Besides HZ vaccine coverage, factors that may be associated with receiving HZ vaccine were examined for adults aged ≥60 years, including: age group (60–64, ≥65 years), immunocompromised status (yes, no), sex (female, male), geographic region of residence (Northeast, South, Midwest, West), health plan type (HMO, Exclusive/Preferred Provider Organization, Point of Service [POS and POS with capitation], other known), primary provider type measured by specialty type of physicians visited during ≥70% of the subject's doctor office visits during the baseline period (i.e., 1 year prior to the index date; primary care physician, specialist, nonphysician professional, mixed primary provider type, unknown), number of healthcare encounters during the baseline period, including inpatient hospital visits (zero, one, two or more); emergency department visits (zero, one, two or more); outpatient hospital visits (zero, one to three, four to six, seven or more); doctor office visits (zero, one to six, seven to 12, ≥13); and pharmacy visits with prescription drugs filled (zero, one to six, seven to 12, ≥13), whether influenza vaccination was received during the baseline period (yes, no), and rurality of residence area (metropolitan, nonmetropolitan−adjacent to a metropolitan area, nonmetropolitan−not adjacent to a metropolitan area, unknown).

Statistical Analysis

Descriptive statistics such as frequencies and percentages for categorical variables and means (SDs) for continuous variables were used to describe the characteristics of the study cohorts. HZ vaccine coverage (%) was reported yearly by age group and by sex, and commutatively by age group. Cox proportional hazards model was used to analyze the factors associated with HZ vaccination for adults aged ≥60 years. Cox proportional hazards model, a type of survival analysis method, differs from

Table 1. Characteristics of Subjects at Cohort Entry

Variable	Age 50–59 years old (*n*=6,770,294)	Age 60+ years old (*n*=6,746,476)
Age, years, M (SD)	53.7 (3.1)	65.3 (8.0)
Sex		
Male	3,184,929 (47.0)	3,147,621 (46.7)
Female	3,585,365 (53.0)	3,598,855 (53.3)
Immunocompromised status[a]		
Yes	262,505 (3.9)	377,634 (5.6)
No	6,507,789 (96.1)	6,368,842 (94.4)
Region of residence		
Northeast	1,100,696 (16.2)	773,612 (11.4)
North Central	1,635,734 (24.2)	2,032,027 (30.1)
South	2,373,221 (35.1)	2,704,866 (40.1)
West	1,428,251 (21.1)	1,176,472 (17.4)
Unknown	232,392 (3.4)	59,499 (0.9)
Health plan type		
HMO	916,788 (13.6)	758,986 (11.3)
EPO/PPO	4,437,128 (65.5)	3,887,887 (57.6)
POS/POS with capitation	536,851 (7.9)	543,257 (8.1)
Other known	723,851 (10.7)	1,398,043 (20.7)
Unknown	155,676 (2.3)	158,303 (2.3)
Primary provider type		
PCP	1,521,399 (22.5)	1,456,929 (21.7)
Specialist	2,156,841 (31.9)	2,276,870 (33.7)
Non-physician professional	171,991 (2.5)	124,648 (1.8)
Mixed primary provider type	1,573,269 (23.2)	1,829,201 (27.1)
Unknown	1,346,794 (19.9)	1,058,828 (15.7)
No. of inpatient hospital visits		
0	6,451,033 (95.3)	6,078,242 (90.1)
1+	319,261 (4.7)	668,234 (9.9)
No. of outpatient hospital visits		
0	3,400,144 (50.3)	2,837,026 (42.0)
1–3	2,438,684 (36.0)	2,584,403 (38.3)
4–6	557,424 (8.2)	733,507 (10.9)
7+	374,042 (5.5)	591,540 (8.8)
No. of emergency department visits		
0	6,676,838 (98.6)	6,626,194 (98.2)
1+	93,456 (1.4)	120,282 (1.8)
No. of doctor office visits		
0	1,144,513 (16.8)	813,391 (12.0)
1–6	3,246,710 (48.0)	2,803,547 (41.6)
7–12	1,244,555 (18.4)	1,566,497 (23.2)
13+	1,134,516 (16.8)	1,563,041 (23.2)
No. of pharmacy visits with prescription drugs filled		
0	2,502,390 (37.0)	1,880,256 (27.8)
1–6	1,561,574 (23.0)	1,157,582 (17.2)
7–12	992,244 (14.7)	1,161,213 (17.2)
13+	1,714,086 (25.3)	2,547,425 (37.8)

Note: Data are *n* (%) unless otherwise noted.

[a]Immunocompromised conditions include: hematologic malignancy, HIV, disorders involving the immune mechanism, aplastic anemia and other bone marrow failure syndromes, organ transplantation, hematopoietic stem cell transplantation, and treatments of chemotherapy, immunotherapy, radiation therapy, tumor necrosis factor inhibitors, protease inhibitors, reverse transcriptase inhibitors, azathioprine, cyclosporine, or tacrolimus.

EPO, exclusive provider organization; PPO, preferred provider organization; POS, point of service; PCP, primary care physician, including family practice and internal medicine.

logistic regression by assessing a rate instead of a proportion. It models the number of subjects receiving HZ vaccine per eligible population per unit time. The follow-up time was censored at HZ vaccination, the end of continuous health plan enrollment, or the end of the study period (December 31, 2014), whichever was the earliest. All statistical analyses were performed using SAS, version 9.3.

RESULTS

A total of 6,746,476 eligible adults aged ≥60 years in 2007–2013 and 6,770,294 eligible adults aged 50–59 years in 2011–2013 were identified. Mean age in adults ≥60 years old was 65.3 (SD=8.0) years and mean age in adults 50–59 years old was 53.7 (SD=3.1) years. About 53% were female in both cohorts (Table 1).

Coverage for HZ vaccine increased from 2007 to 2013 (Figure 1). The vaccination rate was higher in adults aged 60–64 years and women versus the comparators across all study years. By 2013, 1.7% of adults aged 50–59 years, 23.9% of adults aged 60–64 years, and 14.5% of adults aged ≥65 years received HZ vaccine (Appendix Figure 1, available online). When adults aged 60–64 years and ≥65 years were combined, HZ vaccine coverage in adults aged ≥60 years was 19.5% (Figure 2).

Table 2 presents the factors associated with receiving HZ vaccination in adults ≥60 years. Adults aged ≥65 years were less likely to receive HZ vaccine than

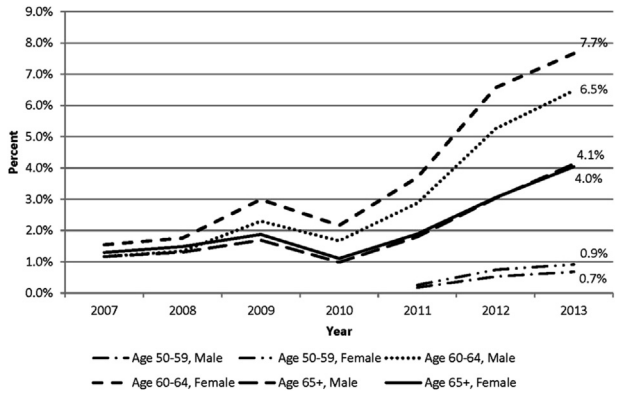

Figure 1. Yearly HZ vaccine coverage by age group and sex, 2007–2013.
Note: Adults 50–59 years old only have HZ vaccination rates from 2011–2013.
HZ, herpes zoster.

those aged 60–64 years (hazard ratio [HR]=0.543, 95% CI=0.540, 0.547). Women were more likely to receive HZ vaccine than men (HR=1.106, 95% CI=1.100, 1.112). Immunocompromised subjects were less likely to receive HZ vaccine than immunocompetent subjects (HR=0.888, 95% CI=0.877, 0.898). Subjects who received influenza vaccine were more likely to receive HZ vaccine (HR=1.841, 95% CI=1.830, 1.853). Adults with more outpatient hospital visits, more doctor office visits, and more pharmacy visits were more likely to receive the vaccine. However, those with more inpatient hospital visits and more emergency department visits were less likely to receive the vaccine. Adults who lived in the South and in the rural areas were less likely to receive HZ vaccine. Adults with Exclusive/Preferred Provider Organization or POS health plan types were slightly more likely to receive HZ vaccine than those with a HMO health plan type. Adults with a primary provider other than a primary care physician were more likely to receive the vaccine than adults with a primary care physician as their primary provider.

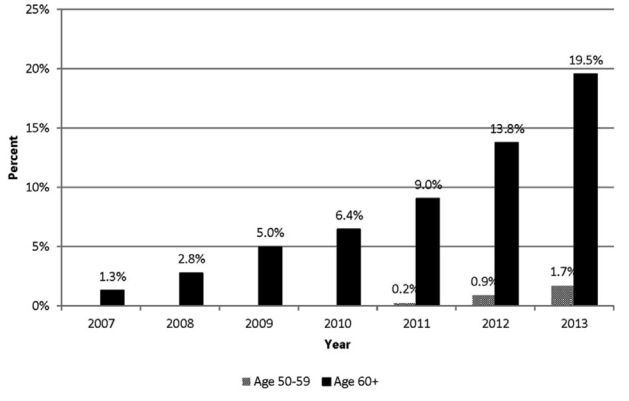

Figure 2. Cumulative HZ vaccine coverage by age group: 50–59 and 60+ years, 2007–2013.
HZ, herpes zoster.

DISCUSSION

This study found that HZ vaccine coverage improved from 2007 to 2013. By 2013, 19.5% of adults aged ≥60 years (23.9% of adults aged 60–64 years and 14.5% of adults aged ≥65 years) received an HZ vaccine. This increasing trend may be a result of several factors driven by greater acceptance of the 2006 ACIP recommendation. However, these rates are still lower than the 30% target of Healthy People 2020.

The overall HZ vaccine coverage estimate from this study, 19.5% for adults aged ≥60 years in 2013, is somewhat lower than the National Health Interview Survey estimate of 24.2% using national survey data in 2013 and Hechter and colleagues'[17] estimate of 21.7% using electronic health records from an MCO in 2011. This could be due to a difference in methodology and the use of different types of data sources (i.e., claims database from multiple payers versus survey, including uninsured populations versus electronic medical record database from a single payer).

Hechter et al.[17] found that HZ vaccine coverage was higher among people aged 65–74 years, women, and non-Hispanic whites. The multivariate analysis in this study also suggested that women were more likely to receive HZ vaccine than men. However, this study showed that adults aged ≥65 years were less likely to receive HZ vaccine compared with those aged 60–64 years whose health benefits should, in principle, cover full cost of vaccines. This may be due to the high copayment for Medicare eligible subjects or complicated provider reimbursement.[18,19] This study also found that immunocompromised adults were less likely to receive HZ vaccine than immunocompetent subjects, reflecting the prescribed indication. Interestingly, this study found that adults who received influenza vaccine were more likely to receive HZ vaccine. This may be because patients who had influenza vaccine were more cautious about their health or generally had a higher level of perceived risk in relation to illness. Research has shown that HZ vaccine is well tolerated and the antibody response is similar when administered concomitantly or sequentially with the influenza vaccine.[20] Similar findings of the association between influenza vaccination and pneumococcal vaccination have also been noted.[21–23] In addition, this study found that adults with more outpatient hospital visits, more doctor office visits, and more pharmacy visits with prescription drugs filled were more likely to receive the vaccine. This could be because patients with more healthcare encounters were more

Table 2. Factors Associated with HZ Vaccination in Adults 60 Years and Older (n=6,529,070)[a]

Variable	HR (95% CI)	p-value
Age		
60–64 years	ref	
65+ years	0.543 (0.540, 0.547)	<**0.0001**
Sex		
Male	ref	
Female	1.106 (1.100, 1.112)	<**0.0001**
Immunocompromised status		
No	ref	
Yes	0.888 (0.877, 0.898)	<**0.0001**
Region of residence		
North central	ref	
Northeast	1.005 (0.995, 1.014)	0.3321
South	0.958 (0.952, 0.965)	<**0.0001**
West	1.381 (1.371, 1.392)	<**0.0001**
Health plan type		
HMO	ref	
EPO/PPO	1.034 (1.026, 1.042)	<**0.0001**
POS/POS with capitation	1.032 (1.021, 1.044)	<**0.0001**
Other known	0.963 (0.953, 0.972)	<**0.0001**
Primary provider type		
PCP	ref	
Specialist	1.050 (1.042, 1.058)	<**0.0001**
Non-physician professional	1.101 (1.080, 1.123)	<**0.0001**
Mixed primary provider type	1.205 (1.195, 1.214)	<**0.0001**
Unknown	1.159 (1.139, 1.180)	<**0.0001**
No. of inpatient hospital visits		
0	ref	
1+	0.693 (0.685, 0.701)	<**0.0001**
No. of outpatient hospital visits		
0	ref	
1–3	1.207 (1.199, 1.215)	<**0.0001**
4–6	1.201 (1.190, 1.212)	<**0.0001**
7+	1.194 (1.181, 1.207)	<**0.0001**
No. of emergency department visits		
0	ref	
1+	0.941 (0.917, 0.965)	<**0.0001**
No. of doctor office visits		
0	ref	
1–6	1.929 (1.890, 1.970)	<**0.0001**
7–12	2.147 (2.101, 2.193)	<**0.0001**
13+	2.307 (2.257, 2.358)	<**0.0001**
No. of pharmacy visits with prescription drugs filled		
0	ref	
1–6	1.444 (1.431, 1.458)	<**0.0001**
7–12	1.580 (1.566, 1.595)	<**0.0001**
13+	1.448 (1.436, 1.461)	<**0.0001**
Influenza vaccine		
No	ref	
Yes	1.841 (1.830, 1.853)	<**0.0001**

(continued on next page)

Table 2. Factors Associated with HZ Vaccination in Adults 60 Years and Older (n=6,529,070)[a] *(continued)*

Variable	HR (95% CI)	*p*-value
Rurality		
Metro	ref	
Nonmetro, adjacent to a metro area	0.805 (0.797, 0.814)	**<0.0001**
Nonmetro, not adjacent to a metro area	0.882 (0.869, 0.895)	**<0.0001**
Unknown	2.783 (2.764, 2.803)	**<0.0001**

Note: Boldface indicates statistical significance ($p<0.0001$).
[a]Subjects with unknown region of residence or unknown health plan type were removed from the multivariate analysis.
HZ, herpes zoster; EPO, exclusive provider organization; PPO, preferred provider organization; POS, point of service; PCP, primary care physician, including family practice and internal medicine.

likely to be informed about the vaccine or be more aware of the recommendation for the vaccine. By contrast, this study found that adults with more inpatient hospital visits and more emergency department visits were less likely to receive the vaccine. These people may forgo the HZ vaccine, owing to other severe illness or contraindication. Finally, this study found that adults who lived in the South and in the rural areas of the U.S. were less likely to receive HZ vaccine. This may be because of lack of access to care or to the vaccine. In the study cohort, residents from rural areas had fewer doctor office visits than residents from a metropolitan area (mean=8.0, 8.2, and 9.4 for residents from nonmetropolitan—not adjacent to a metropolitan area, nonmetropolitan—adjacent to a metropolitan area, and metropolitan area, respectively). Further research is needed in this regard.

The sample used to analyze factors associated with HZ vaccine has more than 6.5 million subjects. Such a large sample is more representative of the population, limiting the influence of outliers or extreme values, and having statistical power to detect significant factors. However, with such a large sample, trivially small effects can be found statistically significant. For example, compared with HMO health plan type, Exclusive/Preferred Provider Organization (HR=1.034) and POS (HR=1.032) health plan types were statistically significant. However, as the effects are so small, they may not have practical significance.

By 2013, only 1.7% of adults aged 50–59 years received the HZ vaccine. Even though the U.S. Food and Drug Administration approved the indication of the HZ vaccine in adults aged 50–59 years in 2011, ACIP did not give the universal recommendation to adults aged 50–59 years. For this reason, adults aged 50–59 years may not be aware of the HZ vaccine, healthcare providers may be reluctant to give the vaccine, and the insurance may not cover the vaccination. Further studies are needed to find the actual reasons for low HZ vaccination rate for adults aged 50–59 years. In the U.S., adults in this age group are most likely still working; HZ has the potential to cause these individuals to incur work and productivity loss. In fact, European studies using patient-reported outcomes indicate that among individuals aged 50–59 years, HZ episodes interfere with work and cause absenteeism due to healthcare visits, pain, discomfort, and inability to concentrate.[24,25]

Limitations

Several limitations inherent to administrative claims data apply to this study. First, HZ vaccines that were not submitted for insurance reimbursement or were received outside the network will not be captured. Furthermore, the study cohort consists of U.S. privately insured population, and therefore generalization may not be made beyond this population. Third, other factors that were examined in previous survey studies, such as race/ethnicity, SES, awareness of the vaccine recommendations, knowledge of HZ, perceived need, and provider recommendation, are not available in claims data. Finally, immunocompromised status is based only on claims database information (without any medical record review). This is likely to result in some misclassification of immunocompromised status.

CONCLUSIONS

The estimated HZ vaccine coverage is 19.5% in adults aged ≥60 years, which is lower than the 30% target of Healthy People 2020. It is important for providers to identify every opportunity for HZ vaccination and to assure that older adults are protected from HZ. Specifically, efforts should be made to encourage HZ vaccination of people aged ≥65 years when giving other immunizations, such as influenza.

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SUPPLEMENTAL MATERIAL

Supplementary materials associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.amepre.2016.08.029.

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